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An Overview on Obesity Hypoventilation Syndrome (Pickwickian Syndrome)

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ABSTRACT

Obesity could also be a growing global concern. One among the results of obesity is Obesity Hypoventilation Syndrome also called Pickwickian Syndrome. This syndrome is characterised by obesity (body mass index), daytime awake hypercapnia, and hypoxemia. OHS is said to excess morbidity and mortality, screening the high-risk individuals is not routinely performed. Unfortunately, the diagnosis is typically missed despite these individuals being heavy users of healthcare resources. The pathogenesis of obesity hypoventilation syndrome is multifactorial, but the opposite of sleep-disordered breathing or more weight loss improves respiratory function and daytime ventilation. Recent data indicate that obesity hypoventilation syndrome is under-recognized and under-treated. Because obesity has become a national epidemic, physicians must be able to recognize and treat obesity-associated diseases. Patients with obesity hypoventilation may present with unexplained hypoxemia or a broad spectrum of symptoms ranging from hypersomnolence or dyspnea to signs of right-sided congestive coronary failure. The right treatment for obesity hypoventilation syndrome is weight loss, which improves most of the physiologic abnormalities thought to be involved within the pathogenesis and ultimately leads to the restoration of daytime eucapnia. Ultimately, any treatment in obesity hypoventilation syndrome aims to correct the underlying problems that contribute to the disease. Weight loss is a perfect treatment in obesity-hypoventilation syndrome. Alcohol and lots of illicit substances are known as respiratory depressants. The use in patient with hypoventilation syndrome may cause coma and death.

INTRODUCTION[2]:

Definition:- Pickwickian Syndrome, clinically referred to as the Obesity Hypoventilation syndrome(OHS) is defined because the combination of triad- obesity, hypoxemia during sleep and hypercapnia during the day, resulting from hypoventilation. It is a combination of obesity and chronic hyperventilation which causes pulmonary hypertension and early death. Most of the people with this syndrome have concurrent obstructive apnea, a condition characterized by snoring, brief episodes of apnea during the night, interrupted sleep and characterized by daytime sleepiness. In OHS, sleepiness could also be worsened by elevated blood levels of carbon dioxide which causes drowsiness.

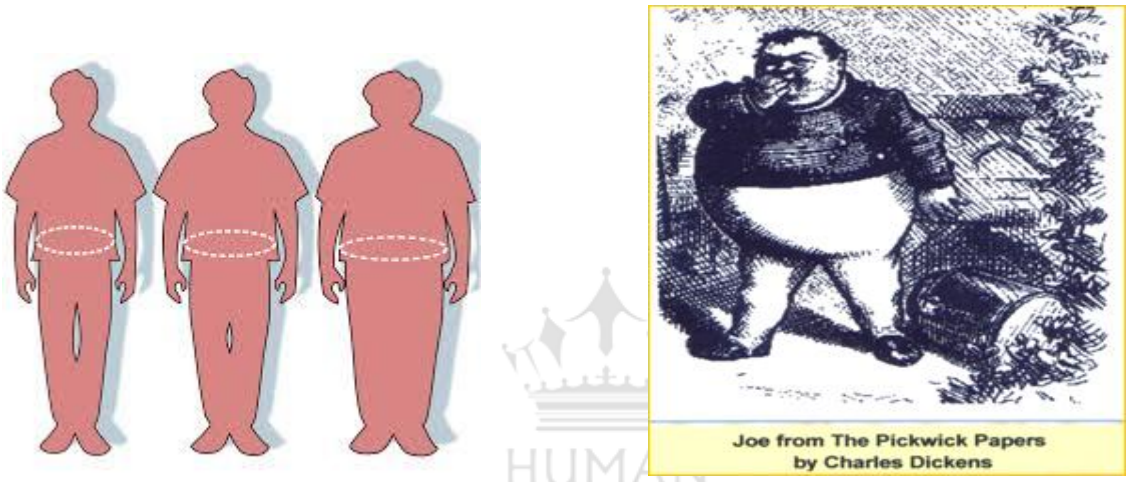

Figure No. 1: Obesity Hypoventilation Syndrome

Epidemiology[2]:-

Although the prevalence of obesity hypoventilation syndrome is unknown, a recent study of severely obese (body mass index 35 kg/m2) hospitalized patients found that 31% had daytime hypercapnia unexplained by other disorders. Although weight alone didn't predict the presence of hypoventilation, almost half the patients with a body mass index of 50 kg/m2 or greater had chronic daytime hypoventilation. Although data have shown men to be at higher risk for obstructive sleep apnea-hypopnea syndrome, an equivalent has not been demonstrated for obesity hypoventilation syndrome.

Morbidity and mortality:-

Evidence suggests this syndrome is related to significant mortality and morbidity. Two older case series, published before treatment options became available and before the routine use of in-hospital heparin prophylaxis, reported high in-hospital mortality rates principally associated with progressive respiratory failure or acute embolism. A recent study found that hospitalized patients had a better 18-month death rate of 23% compared with 9% among patients with simple obesity. Health care providers were informed of obesity-associated hypoventilation, only 13% of patients were discharged with therapies that were known to be implemented.

Etiology[3]:-

No specific, direct explanation for Pickwickian Syndrome is understood by the doctors. However, a mixture of things is assumed to cause this syndrome which includes:
• Obesity, which is measured using the body mass index (BMI); someone with a BMI over 30 is taken into account Obese. Brain's inability to properly control the breathing.
• Improper functioning of the systema respiratorium thanks to extra weight around your chest, which makes it harder for the lungs to draw oxygen from the air.
• Inadequate oxygen to the brain, heart and other essential organs.
• Chronically low oxygen levels, which change body functioning.

How does sleep hypoventilation lead to wake hypoventilation[4]?

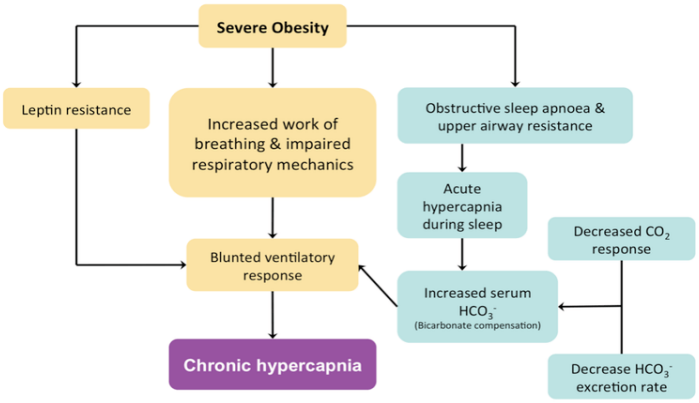

Figure No. 2: Sleep ventilation lead to wake hypoventilation

Pathophysiology[10]:-

After many researches done of this syndrome, still the exact pathophysiology of Obesity Hypoventilation Syndrome is not yet known.

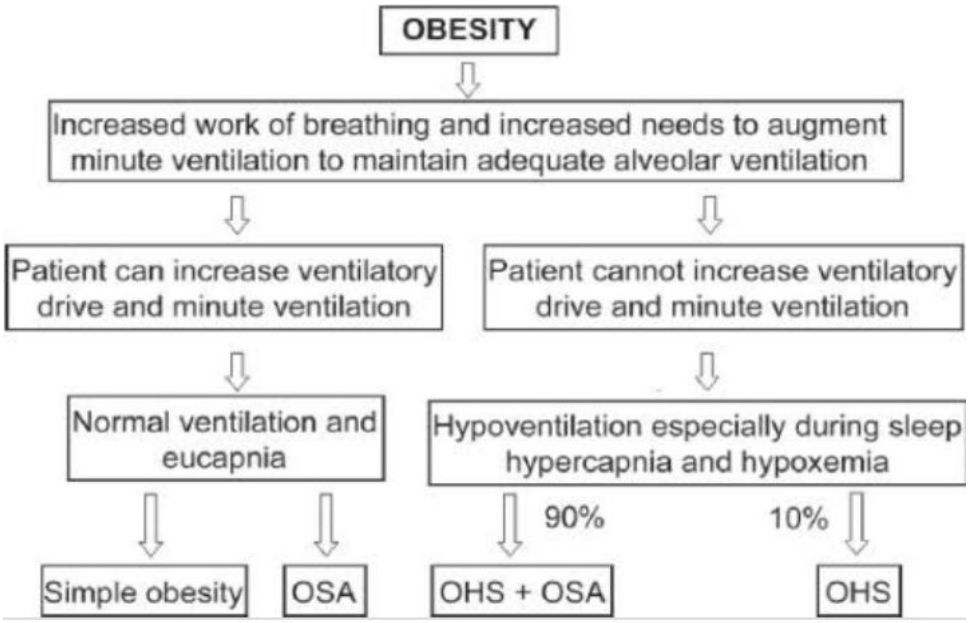

Figure No. 3: Pathophysiology of OHS

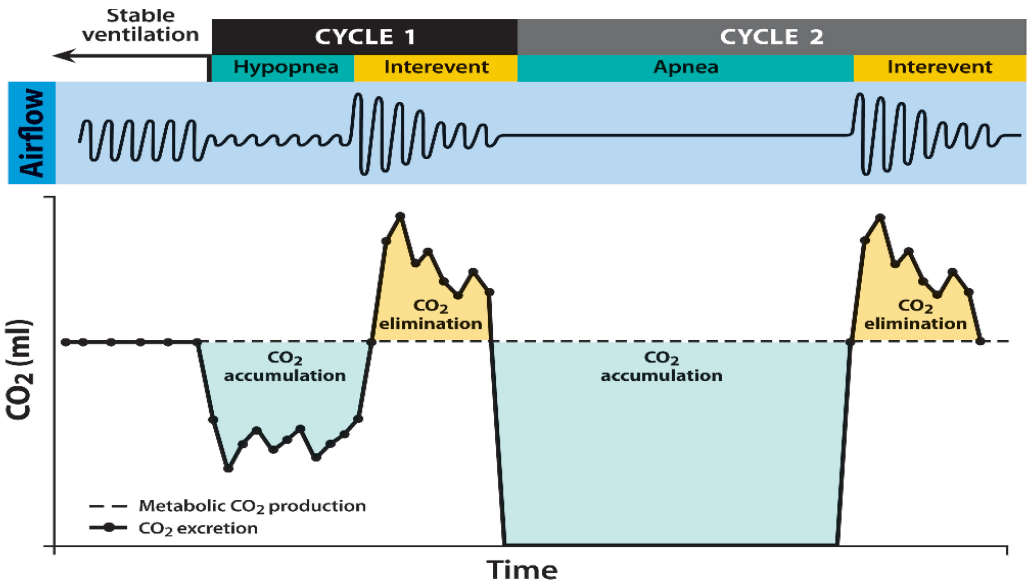

Figure No. 4: Interapnea/hypopnea hyperventilation and carbon dioxide (CO^2) excretion

Symptoms:-

Many Pickwickian Syndrome symptoms are connected to the shortage of oxygen in your blood. This can have effects on your body while the person is awake and while asleep. During sleep, the breathing can become shallow and may even stop for minutes at a time or longer.

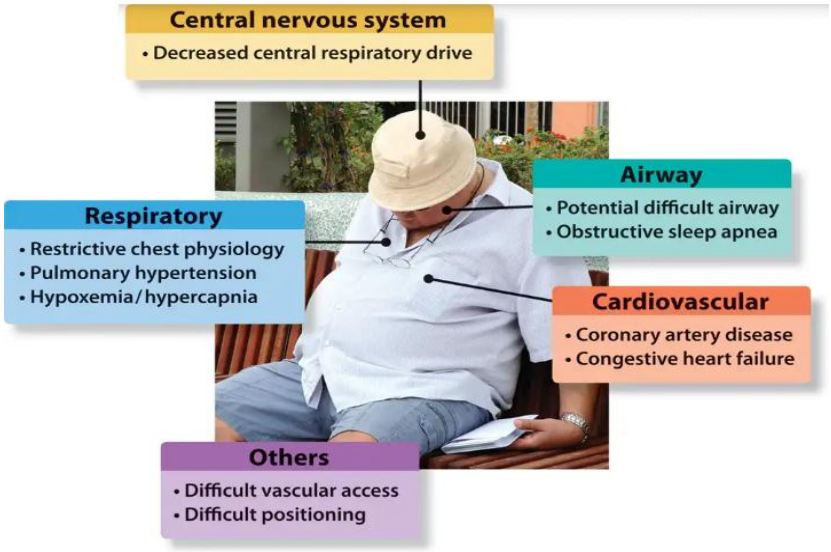

Figure No. 5: Symptoms of OHS

- **Common symptoms include:-**
- Feeling out of breath.
- Having a lack of energy.
- Feeling fatigued or sleepy during the day.
- Swelling or a bluish color in the fingers, toes, or legs (known as Cyanosis).
- Morning headaches due to high levels of carbon dioxide in the blood.
- Symptoms of depression, such as feelings of sadness, loss of interest in activities you normally enjoy and suicidal thoughts.
- Obstructive sleep apnea.
- High blood pressure.

• Cor pulmonale, when low blood oxygen causes the right side of the heart to experience too much tension.

Diagnosis:-

The diagnostic approach focuses on establishing awake hypoventilation in an obese patient in the absence of other causes of alveolar ventilation.

• Polysomnography with continuous nocturnal carbon dioxide monitoring is the gold standard for the evaluation of patients suspected f having obesity hypoventilation syndrome.

• For patients with acute-on-chronic hypercapnic respiratory failure suspected to be due to OHS, immediate treatment with positive pressure therapy is appropriate to stabilize their clinical condition.

• 90% of patients having OHS have obstructing sleep apnea (OSA), in which continuous positive airway pressure (CPAP) is the first model of choice.

• In patients with sleep related hypoventilation and patients with acutely decompensated OHS, bi-level positive airway pressure (BPAP) is the first mode of choice.

Differential Diagnosis:-

The competing diagnosis for the symptoms is Obstructive Sleep Apnea (OSA). Apart from having chronic respiratory acidosis with metabolic alkalosis, both disorders are often clinically indistinguishable from each another.

Common causes for respiratory hypercapnia and alveolar hypoventilation are typically identified by history, examination, pulmonary function testing, imaging, and laboratory findings.

●Chronic obstructive pulmonary disease (COPD) – COPD may be identified in the patients with smoking history, obstruction on pulmonary function tests, and imaging findings for emphysema.

●Interstitial lung diseases (ILD) – ILD could also be identified in those with imaging findings of parenchymal abnormalities and restriction on pulmonary function tests.

●Neuromuscular (NM) disorders – NM disorders are identified by history (eg, weak cough), weakness on examination and muscle weakness on lung function testing. Chest imaging may reveal an elevated hemidiaphragm to suggest diaphragmatic paralysis.

●Chest wall disorders – Such disorders (eg, kyphoscoliosis) could also be obvious on clinical examination or on imaging.

TREATMENT[1]:-

FIRST LINE THERAPY:

Non-invasive positive airway pressure (PAP) at the side of weight loss area unit the initial 1st line therapies for patients with OHS. A comprehensive and multidisciplinary approach utilizing consultants in fat, sleep, and pneumonic medication is usually recommended.

Positive airway pressure:- Patients with OHS have a little variety of sleep-disordered respiration, or sleep-related hypoventilation, warranting treatment with non-invasive PAP. PAP medical care should not be delayed whereas the patient tries to slim down. The choice of the mode of PAP (eg: continuous PAP [CPAP], bi-level PAP [BPAP], volume cycled or hybrid modes of non-invasive ventilation) and step to initiating PAP medical care in patients with OHS area unit represented very well.

➢ The treatment choices for fat hypoventilation syndrome (OHS) is divided into attempt the 2 most vital options of the disorder: weight loss and respiration support.

Goals of Treatment:-

Ultimately, the aim of any treatment in fat hypoventilation syndrome is to correct the underlying issues that contribute to the sickness. The dysfunctional respiration that characterizes the sickness results in associate imbalance within the chemical levels of the blood. Once carbon dioxide can not be properly removed, its levels increase and build the blood a lot of acidic. This triggers a variety of changes within the body which will have negative consequences. Treatment will forestall drops within the gas saturation of your blood, elevation within the red vegetative cell count referred to as erythrocytosis, and coronary failure. Weight loss normalizes gas and CO2 levels. The utilization of CPAP or bilevel, further more as different measures, likewise forestall these consequences.

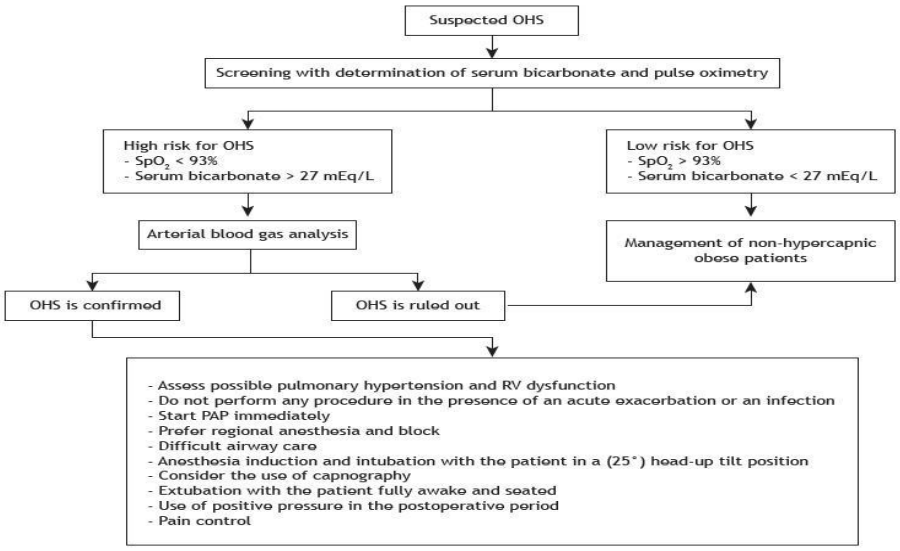

Figure No. 6: Management of suspected OHS

Moreover, sleep becomes less disturbed and this improves excessive daytime sleepiness which results in a better quality of life, which is the goal of any successful medical treatment[7].

• **Weight Loss:-**Obesity is a key contributor to the disorder. If substantial weight losses are often achieved, relief is obtained. This may be achieved through diet and exercise, but more than 100 pounds of weight loss may be necessary. As rapid weight loss might be dangerous, it's recommended that the folks do that under the supervision of their physician. Nutritionists provide help in making behavioral changes. Unfortunately, it's impossible to predict the precise amount of weight that has to get lost for a private to cure OHS.

• Currently, weight loss medications are not recommended to manage the obesity in OHS.

• Although, diet and exercise will not have sustained effects on reducing weight, it may be necessary to opt for surgical options such as gastric bypass surgery. These procedures in people that have overweight and have sleep apnea have increased risks. In particular, the airway may collapse under the anesthesia used for surgery and recovery could also be complicated.

• It is insisted that bariatric surgery be reserved for people who have a body mass index (BMI) greater than 35 and no other medical conditions which could increase the surgical risk. It is helpful to possess a sleep study called a polysomnogram before and after the surgery to

watch the advantages of the procedure. As the weight loss occurs over months, it's going to be necessary to support breathing during this point with other treatments.

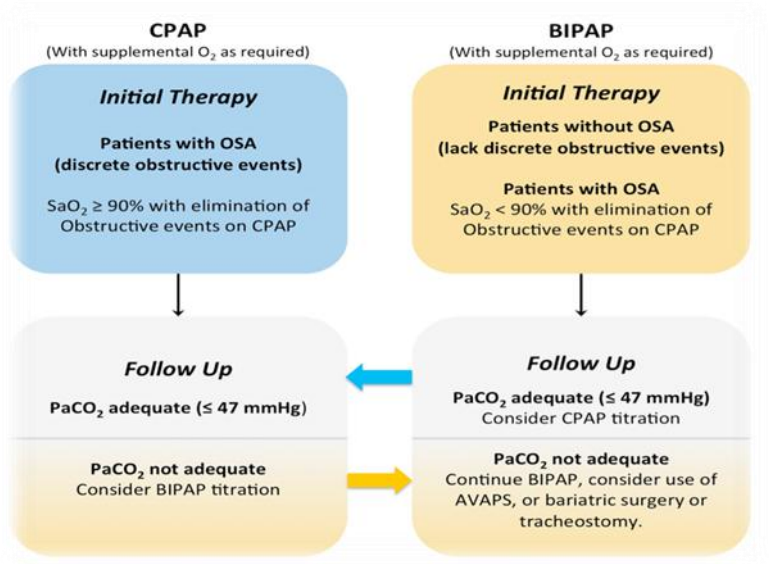

Figure No. 7: Treatment Procedure

• **Breathing Support:-**The mainstay of treatment in OHS is to provide breathing support, often through the use of continuous positive airway pressure (CPAP) or bilevel. These devices generate a pressurized flow of air which will keep the upper airway from collapsing during sleep.

• In severe cases, it may be necessary to perform a tracheostomy. This procedure involves the insertion of a little plastic breathing tube at the front of the throat. This bypasses the upper airway, which is susceptible to collapse or obstruction in people with OHS. Though a tracheostomy is effective, there are problems related to its use. It is often difficult to regulate to the change, especially how it impacts speech. Bronchitis may also occur more frequently. In general, given the other treatment options, it's now rarely used.

• It is necessary to stop using alcohol and certain drugs that decrease your ability to breathe. Possible culprits include prescription medications, such as benzodiazepines, opiates, and barbiturates. You should review your medications together with your doctor to make sure that none of them puts you at increased risk.

Surgery

• Surgery which is associated with hypoventilation[5] includes bariatric procedures to promote weight loss and an electrode is placed on the phrenic nerve for diaphragm pacing. Some patients with thoracic deformities, like kyphoscoliosis, could also be candidates for corrective surgical procedures.

• The hypoventilation refractory cases are due to advanced underlying disease, such as neuromuscular disease, chest wall deformities, or obesity-hypoventilation syndrome, which may require tracheostomy and assisted ventilation for optimal management.

Oxygen Therapy:-

Because many patients with hypercapnia are also hypoxemic during the day, oxygen therapy could also be indicated.

Oxygen therapy is indicated to stop the sequelae of long-standing hypoxemia. Patients with COPD who meet the standards for oxygen therapy have a decreased mortality when treated with continuous supplemental oxygen therapy. Oxygen therapy also has been shown to scale back pulmonary hypertension.

Use oxygen therapy with caution because it's going to worsen hypercapnia in some situations. The presence of worsening hypercapnia following oxygen therapy may be a consequence of ventilation-perfusion mismatching instead of reduced ventilatory drive which is secondary to reduction in hypoxia in case of patients with COPD.

Hypercapnia[6] is best avoided by titration of oxygen delivery to maintain oxygen saturations in the range of 90-94% and PaO_2 between 60 and 65mm Hg.

About 50% of patients with OHS may require oxygen therapy in addition to nocturnal bi-level PPV. Breathing 100% oxygen may worsen hypercapnia in stable patients with obesity-associated hypoventilation, due to a decrease in minute ventilation, leading to alveolar hypoventilation and a gradual increase in the volume of dead space-to-tidal volume ratio. Therefore, oxygen therapy should be given with caution in patients who are obese. Oxygen use alone is usually inadequate therapy for OHS.

Patients with neuromuscular disease shouldn't usually are given oxygen therapy without ventilator support.

Respiratory Stimulants:-

Respiratory stimulants has been used in alveolar hypoventilation but they have limited efficacy. These are generally a final resort and will only be considered with non-invasive pressure ventilation.

- **Medroxyprogesterone:**

The Medroxyprogesterone increases the central respiratory drive and it is shown to be effective in obesity-hypoventilation syndrome and central hypoventilation syndromes. Its effectiveness in COPD is not clear. An Initial studies reporting a reduction in hypercapnia with treatment with medroxyprogesterone was performed in the 1960s.

More the recent studies have documented a downfall in hypercapnia in patients with the obesity-hypoventilation syndrome with associated hypercapnia while receiving total daily doses of 60 mg of medroxyprogesterone in divided doses 2-3 times per day. However, the drug doesn't improve apnea frequency or symptoms of sleepiness. Also, the danger of venous thromboembolism is increased with progestational agents. Many experts do not currently recommend progesterone therapy.

- **Acetazolamide:**

Acetazolamide may be a diuretic that inhibits carbonic anhydrase, increases HCO_3excretion, and causes metabolic acidosis. The metabolic acidosis subsequently stimulates ventilation. However, this medication must be used with caution. If the patient's respiratory system cannot compensate for the metabolic acidosis, the patient may suffer hyperkalemia and, potentially, cardiac dysrhythmia.

- **Theophylline:**

Theophylline elevates the diaphragm muscle strength and stimulates the central ventilatory drive. In addition to being a stimulant, theophylline is additionally a bronchodilator. However, the effectiveness of this medication is limited.

Diet:-

Weight loss is a perfect treatment for obesity hypoventilation syndrome. Weight loss improves the abnormal physiology and restores normal daytime gas exchange. In some of the individuals even a modest decrease in weight of 10 kg improves minute ventilation and normalizes daytime $PaCO_2$. Simultaneously in concomitant obstructive sleep apnea[9], weight loss has been shown to decrease the number of sleep-disordered breathing events (apnea and hypopnea) and therefore the severity of hypoxemia.

Deterrence/Prevention:- Alcohol and lots of illicit substances are known respiratory depressants. This use in patients with hypoventilation syndromes may cause coma and death.

CONCLUSION:-

Since Obesity has become nationally epidemic, it has become easy for health care professionals to treat obesity hypoventilation syndrome. It has been found that obesity hypoventilation syndrome is with higher mortality and morbidity, is under-treated with no proper medication therapy and is not completely recognized. Many Pickwickian Syndrome symptoms are connected to the shortage of oxygen in your blood. The diagnosis for the symptoms of OHS is Obstructive Sleep Apnea (OSA). The exact pathophysiology for this syndrome is not yet known. As the obese population expands, patients with OHS are likely to be encountered more frequently in these practices. These findings are particularly disturbing because effective treatment options exist. Further investigations are needed to completely understand the prevalence, pathophysiology, morbidity, and long-term treatment outcomes associated with this syndrome.

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